Echo Chamber: A Persuasive Game for Reexamining Climate Change Rhetoric

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Abstract

Echo Chamber: A Persuasive Game for Reexamining Climate Change Rhetoric

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Echo Chamber is a game that persuades players to re-examine their argumentation style and adopt new rhetorical techniques procedurally delivered through gameplay. The importance of this game is for two reasons: first, though several games have been made addressing the environmental impacts of climate change, none have examined the gap between scientific and public discourse over climate change; second, to teach players more effective communication techniques for conveying climate change in public venues. *Echo Chamber* was used in our study which gathered empirical data through quantitative and qualitative result analysis. Significant findings in qualitative trends indicate support for our theoretical framework, persuading through procedural rhetoric. Our results provide other developers insight into persuasion through game mechanics with good design practices for similar persuasive games.

1. Introduction

There is a growing understanding that games can be an effective medium for social change. Games for change focus on persuasion, such as forming or changing attitudes over a political agenda, or simply increasing awareness over social issues [18]. Games are theorized to be inherently more persuasive than passive media due to their interactive nature [2], and recent studies have found interactivity and immersion influences an increased willingness to help others and donate to a cause [18, 13]. Persuasive games take advantage of this immersive power by building on the framework provided by learning theorists, game studies (design and practice), and a theoretical foundation offered by the field of communication [11], in order to change attitudes or behaviors [2]. Persuasive games are effective because of procedural rhetoric, the art of persuasion through rule-based representations and interactions rather than the spoken word, writing, images, or moving pictures [2]. This is necessary if persuasive games seek to target social action [11].

Persuasive games can make claims that speak past or against the fixed worldviews of institutions like governments or corporations [2]. It should come as no surprise that persuasive games about climate change exist, but a videogame focused on the rhetoric and language used by those who debate the science is currently absent, despite being covered quite excellently in other media [7]. Games traditionally have stuck to the science of climate change, but haven't delved into the puzzling reality where the science of climate change is all but certain [8], climate scientists are in agreement on man-made climate change [9], yet the public opinion on climate change remains divided [7, 9]. Using procedural rhetoric as a framework, a persuasive game that illuminates the differing arguments of scientists and contrarians showcases the public discourse of climate change in a new and unique way. By taking on the role of a

climate scientist in a videogame, a greater understanding of trials and tribulations faced by scientists will be possible. Therefore, this thesis covers a persuasive game about the rhetoric and public discourse of climate change, to persuade users of more effective communication methods.

To date, there hasn't been a game about climate change discourse. Three games we examined, *SimCity* (2013), *Fate of the World*, and *Oiligarchy* feature climate change to varying degrees. *SimCity* subtly informs how the environment is impacted by the player's actions. *Fate of the World* features little agency, telling players facts rather than showing. *Oiligarchy* persuades through gameplay mechanics, and illustrates how satire could enhance or detract from a game. These games do not demonstrate how climate change is communicated, but their successes and failures informed our design.

Using procedural rhetoric, we created a persuasive game where the player character embodies a climate scientist engaged in the public discourse of climate change. The rules and processes of this game reflect the challenges faced by scientists who engage the merchants of doubt. Levels in game are based on research to better communicate climate science and televised debates, to facilitate the goal of this project: persuading players to re-examine their argumentation style and adopt new rhetorical techniques delivered in game, while fostering a sense of empathy for scientists thrust into the limelight.

1.1 Research Question

Using procedural rhetoric as a framework, how can a persuasive game illuminate the rhetoric of climate change denial and the public discourse of climate change?

2. Literature Review

In this chapter, we briefly examine the methods and strategies utilized by climate change denial and the impact it has on scientists. Second is an overview of persuasive games. We begin by outlining persuasive games, followed by defining procedural rhetoric, and an examination of wicked problems, ethics in games, and the validity of entertainment in persuasive games.

2.1 Climate Change Denial

There is scientific consensus regarding man-made climate change [7, 9], but it remains a fiercely contested political issue [1, 10, 3, 9], influencing the public discourse of climate change. Climate scientists attempting to validate climate change to the public are outclassed by contrarian opponents [7, 9]. Scientists stick to factual arguments, which is promptly answered with short, loud, and memorable responses. Evidence is argued to be flawed, or is thoroughly disputed through little scientific backing [7, 9, 3, 15]. Arguments are constantly shifted; "climate change isn't real" becomes "climate change is real, but humans aren't the cause" [7]. This opposition is climate change denial.

Climate change denial promotes false experts and a magnified minority to give the impression of disagreement within the science community; commits logical fallacies; expects the impossible for any solution; cherry picks research for evidence that aligns with their agenda; and promotes the idea of a global conspiracy theory amongst climate scientists [9, 3] . These merchants of doubt are master rhetoricians, but are not scientists, even though they "often play one on TV" [7]. The media buys into the ordeal, where false experts are given equal footing with actual climate scientists.

This scenario, and these denial tactics, influenced the setting of our game, and the antagonist's design.

Recognizing scientists' difficulty at reaching the general public, researchers at Columbia University developed methods for effectively communicating climate change [4]. Delving into human psychology, the researchers stress an avoidance of technical jargon, illustrating evocative scenarios, and making climate change relevant to an audience. These tactics, and others outlined, are the basis of what our game is informing players. Our goal is to persuade players to utilize more effective methods of climate change communication, and is reflected in our design.

2.2 Persuasive Games

In the computer game *Spent*, the player is thrust into the story with the instructions that he's just been laid off, and is challenged to survive one month living on a minimum wage job. Following this, he chooses how to spend his ever diminishing funds. For this reason, *Spent* persuades effortlessly through gameplay; the game is built upon the one mechanic of spending, a mechanic that is immediately, almost painfully, familiar to the player. The game offers randomized choices mixed with challenges such as the player character's car needing repairs to highlight the expensive reality of poverty (Figure 2.1). Because the player is experiencing this interactively, and is forced to make the difficult choices, he is persuaded through play. The power of persuasive games is that they're able to put us in unique situations interactively, in order to prompt new knowledge or understanding about the subject, leading to an attitude or belief shift [2]. Ruggiero agrees, finding *Spent* increased positive attitudes towards the homeless [11]. Persuasive games are effective at attitude changes such as this due to procedural rhetoric.

Figure 2.1: Example of Gameplay in *Spent*

2.2.1 Procedural Rhetoric

Procedural rhetoric is the practice of using computational processes persuasively, just as verbal rhetoric is the practice of using oratory persuasively and visual rhetoric is the practice of using images persuasively; procedural rhetoric entails changing opinions or actions and procedural rhetoric entails expressing ideas effectively [2]. Bogost is arguing is that videogames, being both computational processes and expressive media, are a new form of rhetoric, as opposed to simulations or other rules based software. Put simply, procedural rhetoric states that in order to be a persuasive game, the game design, rules of the game, and the mechanics by which the game is experienced, must be designed to support and reflect the subject matter. Even more simply, the mere act of playing a videogame must be persuasive. In playing videogames, Bogost believes we quite literally explore an argument when we manipulate the controls, and in doing so we may see how things do and do not work, which is the crux for persuasive games [2]. For a game to illuminate the public discourse of climate change, it makes the most sense to have the player character be trapped within the discourse itself, so knowledge of the situation can be obtained first hand.

2.2.2 Ethical Games and Wicked Problems

True ethical quandaries in videogames are different than the common moral dilemmas that are present in popular commercial videogames. Sicart argues that moral decisions are evaluated by players as strategies, not as a moral or immoral action, and ethical gameplay, therefore, is a pause in the action for the player to reflect upon their behaviors, not a binary decision [14]. To achieve truly ethical gameplay, Sicart and Swain propose utilizing wicked problems, which are originally defined as a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision-makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing [14, 17]. A wicked problem is a situation where there is no one right solution.

In *Papers, Please* the player character is an immigration inspector, and contains excellent wicked problems. Early on, the player is presented with a scenario where a husband and wife are crossing the border. They will be killed if they cannot flee their home country. The husband's paperwork is in order, but the wife is missing crucial pieces. The player can choose to send the wife back to her home country, damning her in the process, or allow her entrance, at the expense of a citation and a fine imposed. As the player character is quite impoverished, he must weigh his family going without food, heat, or medicine, to allow the woman passage. There is no right answer in this situation, but one must be painfully made, demonstrating the power of a wicked problem. Wicked problems are a crux of our game's design, which is discussed in Chapter 4.

2.2.3 Empathy in Design

Belman and Flanagan advise that designers of persuasive games need to consider the role of empathy, as it allows players to inhabit roles and perspectives of others in a

uniquely immersive way [5]. They outline four design principles to follow: players are more likely to empathize only when they make an intentional effort to do so are the start of the game; give players specific recommendations about how their actions can address the issues represented in the game; a short burst of emotional empathy works well if players' beliefs are not required to shift drastically; and emphasize points of similarity between the player and people or groups with whom they are supposed to empathize, but beware of provoking defense avoidance. If players can empathize with the subject matter of a game, then a behavioral or attitude shift is possible. Belman and Flanagan's design principles influenced the opening of our game, illustrating the player character's dilemma.

2.2.4 Entertaining Persuasion

Swain outlines seven practices for designers of persuasive games to follow, based on his own experience as a designer and researcher [17]: define intended outcomes; integrate subject matter experts; partner with like-minded organizations; build a sustainable community; embrace wicked problems; maintain journalistic integrity; measure transference of knowledge; make it fun. The practices listed are fairly self-explanatory, however the last one, make it fun, is possibly the most important- designers should strive to achieve a game that is both fun and imparts a social message [16].

Far too many serious games fall into the trap of having a topic, and then building a game around the subject matter without considerations into gameplay. Fun is a great strength of all well-designed persuasive games - they are specifically created to engender goodwill toward players in a very practical way: entertainment [12]. With our project, the effectiveness of the persuasive elements benefit by making the strongest game for the subject matter, and is entertaining to play.

3. Climate Change in Videogames

Climate Change is a fairly popular subject for videogames, even amongst commercial releases. We examine three examples, one commercial and two persuasive: *SimCity*, a commercial title, *Fate of the World* and *Oiligarchy*, the persuasive games. *SimCity* was not built to be persuasive, but is an engaging game that happens to teach the player about environmental degradation. *Fate of the World* is dedicated to informing the player about ecological disasters resulting from climate change, but is ineffective as much of the information is told to the player rather than experienced. Finally, *Oiligarchy* is an excellent example of procedural rhetoric, as its rules and processes are designed to inform the player through gameplay.

3.1 SimCity

SimCity, the newest in the city building franchise, prominently features the ability to manipulate the environment due to the player's choices in development. Should he choose to be an oil centered city, for example, then he will need to accurately drill the ground. He needs to be cautious, as the game will cause mass evacuations of cities should the player overly pollute the ground. *SimCity* does not leave the environment to oil barons, however, and allows the player to create a green city of the future, with an impressive wind simulation. Players are informed that their pollution will affect neighboring cities should they build power plants along an air current that travels to said neighbors. These simulations, however, are merely ancillary to *Sim City's* rules.

The rules of *SimCity* are not to enlighten the player on climate change but rather to entertain. *SimCity* is devoted to fostering the player's development into the best possible city manager, and to have fun in the process. It's because of this that *Sim*

City is able to quietly teach the player environmental information. The game is well designed and thoroughly engaging - learning is that much more potent when it's entertaining [6]. *Sim City* does not portray climate change communication, but it could function as a compelling learning tool. We took note of this, and designed a game that's enjoyable to play while learning.

3.2 Fate of the World

Thrusting players into the role of the "GEO" (Global Environment Officer), *Fate of the World* is far less open ended than *SimCity*. A series of cataclysmic scenarios are available, such as "Oil Fix It," with the singular goal of reaching the year 2080 while continuing to drill for oil. Each level has the same goal of reaching a further out year, with no less than four lose conditions. *Fate of the World* even outdoes *SimCity's* array of city managerial options - the UI (User Interface) is structured around a satellite view of Earth, with options to deploy agents into regions, in depth graphs for the various impacts of global warming, and the ability to play cards to advance the game. As the game clock advances, players are also given news reports based on the stage, and factors such as the global population.

The problem with *Fate of the World* is that this singular motive of persuading players about the horrors of climate change is not experienced through meaningful play. The impressive amounts of scientific data contained within are often jargon filled, and require entering the game able to parse much of its cluttered interface. This overt dedication to portraying every scientific facet related to climate change overwhelms its ability to function as an enjoyable game. *Fate of the World* is not an effective persuasive game, and was a good lesson for our design in not letting science overwhelm gameplay.

3.3 Oiligarchy

Oiligarchy , quite possibly the most cynical game listed so far, allows players to become the oil baron themselves (Figure 3.1). The game starts after World War II, and the player strikes it rich with oil refineries in Texas. As his wealth grows, so does his influence, and the world becomes more addicted to oil. Soon enough, the player has enough money to literally buy the presidency and Congress, and is able to effectively reshape the world to his needs for oil consumption. *Oiligarchy* is an excellent example of procedural rhetoric in action, as every rule, every process in the game is built upon examining the wide influence of the oil industry.

Figure 3.1: *Oiligarchy's* Gameplay

Oiligarchy was hugely influential on our design process, due to it functioning as both a game and as a persuader. *Oligarchy's* message is delivered strictly through interactive gameplay built for that message. The large asterisk then is the game's satire. *Oiligarchy* is incredibly satirical, possibly overtly so. This is not a game for everyone; it's divisive, loud, and unapologetic. For *Oiligarchy*, this is inexorably part of the experience. For our game, one that is also satirical, we purposefully did not satirize to the same degree, as it could detract from the experience.

The three games listed represent just a fraction of the games available dedicated to spreading awareness about climate change and related topics. However, none have directly addressed climate change communication. *Oiligarchy* does allow the player to influence public opinion through brute force, but there remains freedom of the press, and a strong environmental resistance. *SimCity* and *Fate of the World* are more concerned with the broader topic of climate change and the ramifications, rather than the active attempts to deny. There exists a need for a game to portray the rhetoric and public discourse of climate change.

4. Design Rationale

Echo Chamber is a persuasive game that illustrates how climate change can be more effectively communicated in public venues. By combining gameplay with interactive storytelling, this game aims to teach the player effective methods of disseminating scientific information against the tactics of climate change denial, while imbuing the player with a sense of empathy for scientists engaged in debates. This is done through a branching narrative debate mechanic, where the player's choices affect how successful he is in game, and determines the final outcome for the player character. He makes these decisions based on what he believes is the most effective at winning the argument. The game provides immediate feedback, both positive and negative, to emphasize the stressful environment, and to facilitate persuading the player. The purpose of this game is to teach rhetorical strategies for climate change communication through procedural rhetoric and does so through its design.

Many components are attributed to the creation of *Echo Chamber*. These include why the game was made, game design, level themes and narrative design, visuals, and forms of feedback.

4.1 Design Goal

For scientists, their argumentation style is entirely factually based, and relies on technical jargon. This has partially led to the disconnect between scientific and public perceptions of climate change. Scientists need to learn new styles of discourse, and for this reason we determined *Echo Chamber's* two main goals: 1) To teach the player effective methods of communicating scientific data in public venues through game design. 2) Imbue a sense of empathy in the player for scientists engaged in debates

against climate change denial.

To best achieve these design goals, the player character in *Echo Chamber* is a climate scientist, and is thrust into a series of televised debates against an opponent taking a contrarian opinion. We designed *Echo Chamber* to force the player into the stressful environment of televised debates, so he may become more knowledgeable of effective techniques in the process, and foster a sense of empathy for scientists.

4.2 Game Design

The player experiences the stressful nature of being a scientist engaging in televised debates. These stressors include the difficulty in communicating scientific data understandably, the media presenting both men on equal terms in the quest for ratings, and highly contrarian opponents. The stressors are procedurally delivered through the game design, as the player takes on the role of the main character in a series of televised debates.

Echo Chamber is built upon one game mechanic: selecting dialog. Every round, the player is presented with three options: the correct response based on the level's theme (discussed in section 4.3); a neutral response, commonly a less impactful version of the correct response; and "wrong" - an answer that is too technical for the layperson, is not relevant to the situation, or is too emotionally charged - e.g., an aggressive comment at the opponent. The message being parsed to the player throughout gameplay is that the best of intentions can be disregarded if not communicated properly. Adopting tactics used by the opposition, or using facts and data without adapting them to the current arena will result in a losing outcome. Each choice is timed (12 seconds, determined through informal playtests), with a selection being made for the player once time has elapsed. The time pressure was added to immerse the player in the game's debate. Real debates generally will not allow for an unlimited amount of

time to speak, so it must function similarly in our game. Our design intent is that through this mechanic that the player is able to learn while playing, ideally answering based on what he thinks the player character would say at the given moment, or a more understandable version due to the player's identity outside of the game world.

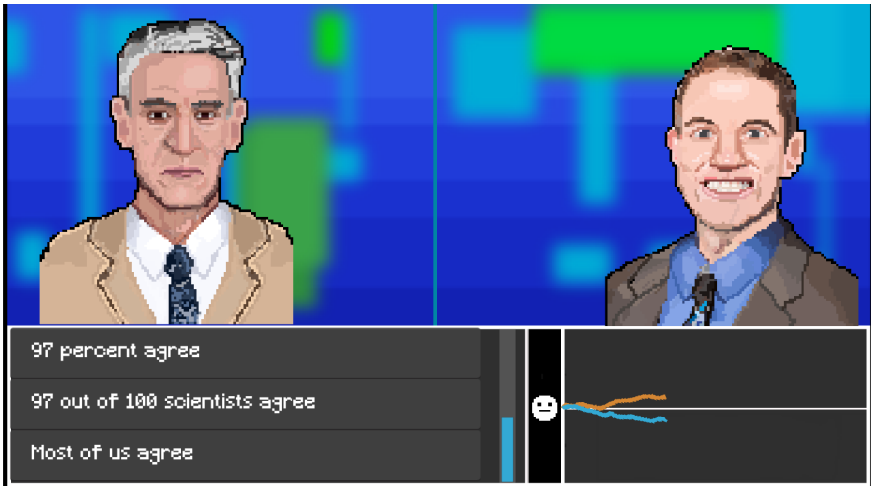

Figure 4.1: Gameplay with Dialog Options

Choices are worded so that minor variations in phrasing are the difference between technical jargon and effective communication. The difference is subtle - e.g., "97 percent agree," vs "97 out of 100 scientists agree" in the figure above. Hints are afforded to the player in how dialog is worded; an option that's relevant to the audience will include the name of the city or an event that occurred in that location or an emotionally charged appeal to the audience is often quite obvious due to the nature of the wording ("I'm frightened of climate change" and "appeal with patriotism"). Each choice the player makes is recorded by the game, and he is shown his answers with the correct option at the culmination of the level. Choices deliver immediate feedback to the player, with the exception of the neutral option. The goal of these

forms of feedback is to make the player abundantly clear what is right and wrong according to the rules of the design. This feedback helps the player learn how to effectively communicate scientific data, and procedurally empathize with the player character.

Further feedback is experienced by the player during interlude levels, where the player's performance dictates the dialog he receives from an non-player character (NPC), his producer. The NPC primes the player for each level by delivering instructions on how to choose dialog options correctly, and relaying the level's theme that all choices will adhere to.

4.3 Level Themes

Echo Chamber is split into three distinctly themed levels. These themes are based upon work done by researchers at Columbia University [4], outlining eight techniques for effectively communicating the reality of climate change (figure below). Our design is based upon the principles we chose to be suitable: "Translate Scientific Data into Concrete Examples," "Address Scientific Uncertainties," "Know Your Audience," and "Beware the Overuse of Emotional Appeals." We chose these tenants because they best lent themselves to the setting of our game, a televised debate, and could be illustrated through gameplay. With these techniques chosen, the levels were designed around teaching these strategies to the player.

Figure 4.2: Techniques for Communicating Climate Science

The first level, "Make Science Understandable," emphasizes the need to describe scientific terms in a distinctly high level manner. Utilizing technical language, e.g. anthropogenic instead of man-made, has the unfortunate effect of being overly complicated for the audience and can be off-putting. With the design, the first level emphasizes the need to be precise - percentages are more easily understood compared to fractions, choosing to say a jargon laden dialog option will cause the player's rating to plummet, and taking the largest piece of inspiration from the research document, selecting words and evidence that are not easily misconstrued or can be manipulated by the opposition. It is for this reason that the antagonist will take advantage of any opportunity the player affords him, spinning an imprecise or jargon laden bit of dialog to his favor. Through this, the player will also learn to not engage the antagonist,

and speak to the audience.

The second level, "Know Your Audience," teaches how to frame climate change as a relevant topic depending on the audience. Some methods include referencing the current location, and framing effects as they pertain to that location; focusing on the present, as this is more relatable than future disasters; and trying to capture both the analytic and experiential sides of the human brain through data and vivid imagery. Dialog options in this level range from a change in location ("Effects were felt in New York," vs "Effects were felt in Canada"), differing groups of people, and tackling climate change as an opportunity rather than a looming threat. Other framing methods are utilized throughout the level, such as framing climate change as a militaristic problem, though these methods are not the primary focus.

"Emotional Appeals," the final level, emphasizes using the titular emotional appeals in conjunction with factual statements. Through this, the player learns not not overuse emotional appeals, such as scare tactics, as the audience has a finite state of worry[4], and will cease to listen to the player character once that threshold has been passed. In gameplay, this is illustrated by having the player's score plummet once he has utilized an emotional appeal greater than the allotted amount. Dialog options are similarly designed to follow this rule, as each choice is optimistic ("We can change the world"), data driven, or pessimistic/realistic ("We have to spend now to avoid enormous losses"). The Player is encouraged to strike a balance with facts and rhetoric, as the player character and the antagonist debate climate change in a more conceptual fashion.

4.4 Narrative Design

With the opening cutscene, the stakes are set for the player character. He is Phil Hugh, "The Science Dude," a fictional version of Bill Nye, science educator and

frequent subject of televised debates. To aide in procedurally developing a sense of empathy for the main character, the player is informed that due to poor ratings, Hugh has three chances to redeem himself to his producers. This simple story element has the added benefit of giving the player agency as redemption can be a powerful motive. The main character being paired against his polar opposite, Glen, a man who denies climate change. The producer NPC informs the player that his performance will be evaluated in real time, and between stages through email.

The antagonist is a personified amalgam of techniques utilized by climate change denial. He is a cunning opportunist, ready to take advantage of any misnomer made by the player, unleashing one of several techniques to spin the dialog in his favor. These techniques include cherry picking research mentioned by the player, arguing with aggression and bravado to overwhelm, and finding flaws in any possible solution [7]. The antagonist is also inspired by three debates featuring Bill Nye; the first features Nye being thoroughly outclassed by his opponent. From the beginning of the debate, the opponent tactically unnerves Nye by being rude, or insulting him, and proceeds to rapid-fire a string of memorable one-line quotes (e.g. "The Hockey Stick is broken!"), while asserting that peer-reviewed literature supports his claim that climate change is not man-made. The opponent in this debate was the largest influence on the antagonist's character development. The second Nye debate has him against an economist, who consistently questions tackling climate change from a monetary standpoint - his dialog is partially adopted into the second level. The final piece of influence comes from Nye debating a conservative politician. This politician's assertion that climate change may be beneficial for agriculture and the economy inspired the majority of the antagonist's dialog in the final stage.

The player's performance in game branches the narrative, with every dialog choice affecting the player's score. This score is tracked through the game, and it determines

the feedback the producer parses through an email in four interlude levels, seen in figure 5. If the player's total score is above a certain threshold at the end of a level (4 on level one, 8 on level 2, and 15 on level 3), feedback is positive, with the producer praising the player character, and the inverse for a lower total score. After feedback is given, the producer gives the player character hints on how to do well in the upcoming level. For example, before the second level, the producer will mention keeping all of the player's arguments relevant to the local population, an important facet of appealing to an audience. The instructions are a vital part of our design, as they convey many of the techniques needed to communicate scientific data in a more effective way. The narrative branching ultimately leads to one of two outcomes for the player: either he wins, or loses. If the player is able to communicate scientific data effectively, then he wins the game, and can choose to remain with the show or leave. If the player choses dialog options laden with technical jargon, irrelevant information, etc, then he loses, and is fired by the producer NPC, the "bad" ending. These outcomes are to demonstrate that with communication, there is no middle ground: either it is done well, or is ineffectual.

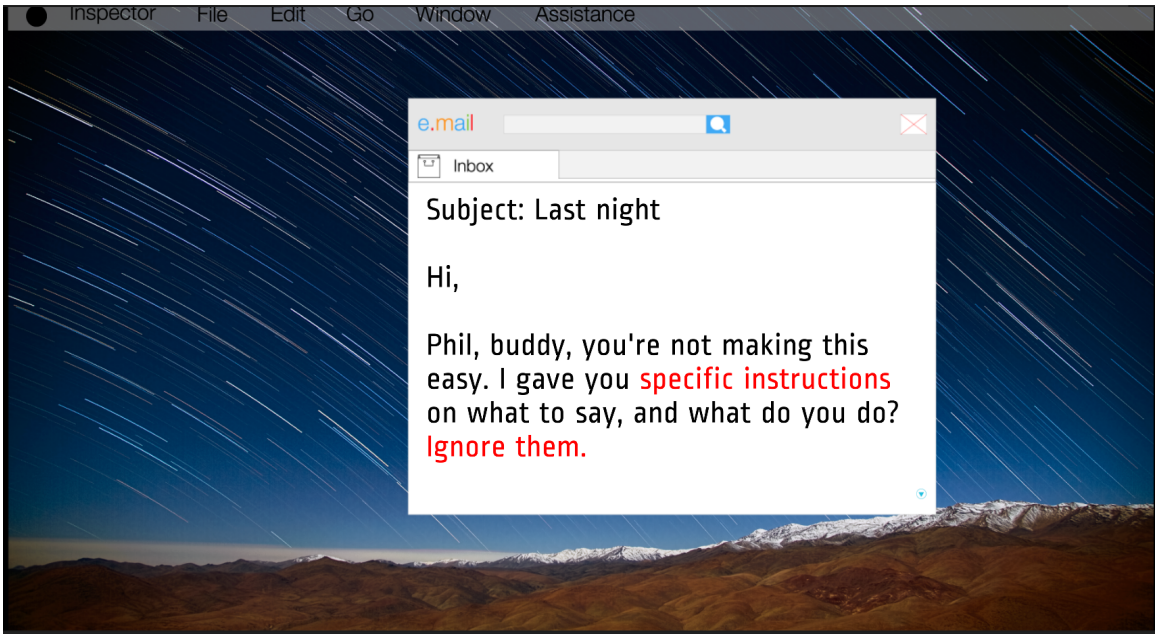

Figure 4.3: An Example of Negative Feedback

4.5 Visual Design

Echo Chamber's visuals are influenced and satirizing the design language of real world products and presentations, to tie the game's events with reality. This includes Google's email client Gmail, Apple's OSX operating system, and CNN's visual language having the largest impact. For example, the in game "e.mail" screen borrowing the thin sloping lines, curved tabs, and color palette utilized by Gmail. In gameplay, this concept is taken further, with the feedback graph being a visual reminder of CNN's opinion graph showcased throughout debates, seen in Figure 6. For *Echo Chamber*, the plus and minus symbols are changed to sprite faces for an easy to understand method of feedback. This was done for two reasons: 1) the graph is inherently confusing, and its purpose is to add to the player's stress level; 2) the instantaneous, satirical feedback afforded by the smiley faces keeps the player engaged with learning from the dialog, and not fixated on the graph. Presentation in

game is additionally built upon CNN's design, with banners utilizing their design language (Figures 5 and 6), the blue/green background based on a common newsroom backdrop, and dueling talking heads, seen in Figures 7 and 8.

Figure 4.4: CNN's Graph at the Bottom of the Image

Figure 4.5: Example of CNN's "Breaking News" Banner

Figure 4.6: Our Game's Banner

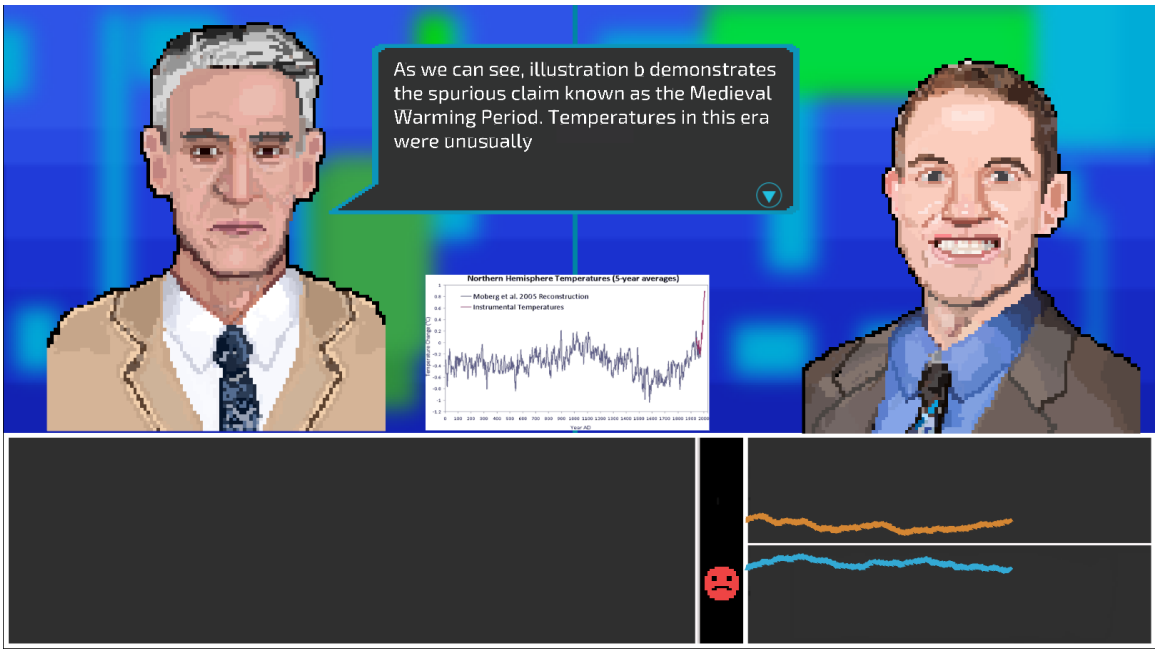

Figure 4.7: In-Game Screenshot

Figure 4.8: CNN's Presentation Style

The added benefit of relying on these designs is that a natural framework for presenting and choosing dialog is created. Dialog options are shown to the player in a role-playing game (RPG) like manner, with all three appearing in the bottom third of the screen. The player's eye is then drawn to the timer immediately to the right, reinforcing the stress of choosing the correct option (Figure 9). Characters in game share the speech bubble, with dialog presented at eye level in another nod to RPG layouts.

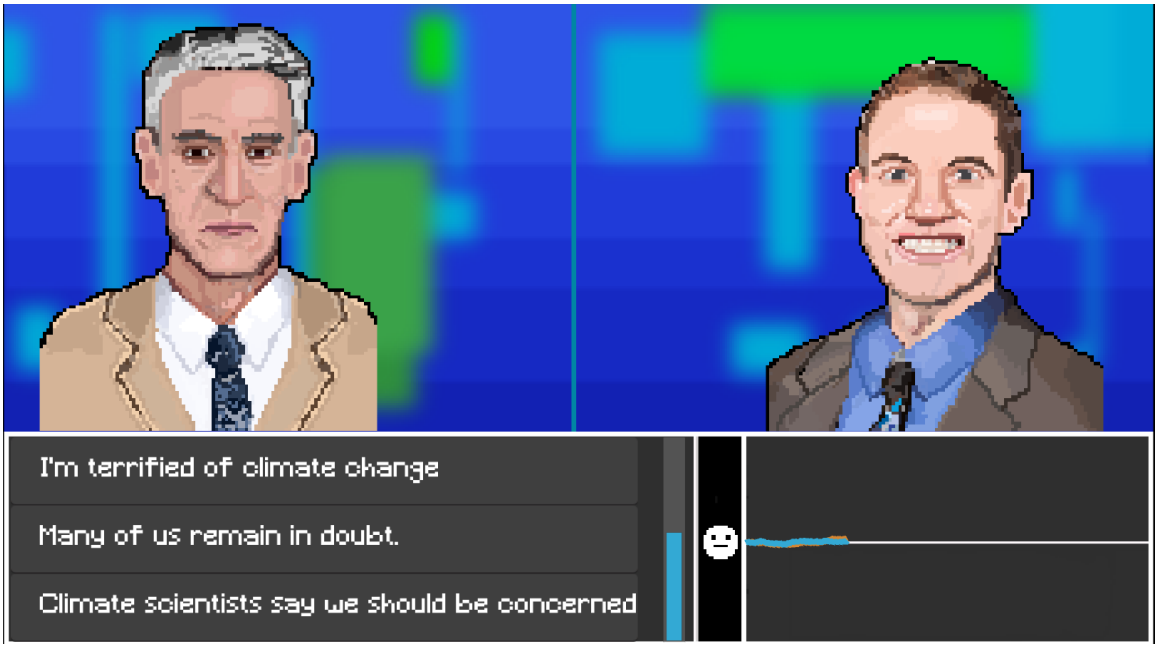

Figure 4.9: Dialog Layout, with Selections, Timer and Feedback Graph

Finally, visual feedback is generated after every dialog choice (Figure 10), except for the neutral option. This feedback consists of words: "Good," "Keep it up!," "Relevant!," "Wrong," "Nope," "Ugh," and "What?" This was done to add an immediately understandable response to the player's choice, and to further aid in teaching him.

Figure 4.10: Example of Positive Visual Feedback

5. Empirical Study

We designed our study to judge the effectiveness of persuading participants to utilize effective communication techniques for climate change through video game mechanics. With this study, we hoped the data acquired would demonstrate participants learned these techniques by re-examining their current rhetoric, and concurrently show how to design similar persuasive games. The study entailed participants filling out questionnaires before and after playing *Echo Chamber*, with a select group of experts and graduate students asked to answer more in-depth questions from an investigator.

5.1 Study Design

The following details the methods we used to design our study.

5.1.1 Study Goals

A successful outcome for the study would show participants expressing how scientific data must be reframed for different audiences and understand our approach of stressing this concept through the game mechanics, while showing a marked increase in empathy or sympathy towards science communicators. We also hope to document participant feedback to further improve and expand our game, and illustrate our design principles so similar persuasive games aiming to teach participants can build off our results. A negative outcome would be the exact opposite. Failing responses would show no understanding of communication methods or not finding the design decisions to be effective. We were aware that there may be no change in empathy, due to participants entering the study already empathizing with scientists, and their

set beliefs.

5.1.2 Participants

The majority of participants were students of Drexel University's College of Arts and Sciences, aged 18 through 28. This falls within the age range of freshman and graduate students. We selected this group for their interest in the subject matter of our game. Other participants were aged 30 through 64, and were employed in scientific fields, technical communication, or part of Drexel University's digital media program. It was hypothesized that participants would gain an awareness or understanding of how scientific data must be communicated in order to appeal to audiences. The target sample size was 40 participants, with 46 total. The majority of individuals played the game online on their own time, with instructions emailed to participants. Large groups were recruited through email during their attendance of Drexel University Environmental Policy and Communication classes. Remaining participants were recruited directly through email, or in person by an Investigator.

5.1.3 Study Procedures

The study began with participants filling out our pre-questionnaire. The pre-questionnaire asks participants for their age, gender, ethnicity, how often they play videogames, how often they watch or read the news, their political identity, and a combination of quantitative and qualitative questions related to scientific communication.

Seven questions were asked in the pre-questionnaire (Table below). These were designed to collect data on a participant's opinions towards elements of scientific communication that might change after playing the game. There were 4 quantitative questions and 3 qualitative questions. Quantitative questions asked 1) their feelings

towards scientists in the media, 2) feelings towards politicians and journalists in the media, 3) the national media's role in climate change and 4) their level of empathy towards scientists presenting in public venues. Qualitative questions asked 1) their feelings towards climate change 2) experience playing persuasive games and 3) potential effectiveness of a persuasive game.

No.	Questions
1	Briefly, how do you feel about climate change and why?
2	How do you feel about scientists that are presented in the media when discussing climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
3	How do you feel about politicians and journalists that are presented in the media when discussing climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
4	How do you feel about the national media's (CNN, MSNBC, etc) role in presenting climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
5	Do you feel empathetic or sympathetic for scientists who present on climate change in public venues, such as the news? 1. Strongly disagree, 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree
6	Have you ever played a persuasive videogame? (A videogame designed to shift opinions or beliefs)
7	How effective do you think a persuasive videogame (a videogame that is designed to shift opinions or beliefs) could be at portraying the public discourse of climate change, while creating a sense of empathy for scientists who are thrust into public venues?

Table 5.1: Pre-Study Questionnaire

After filling out the pretest, participants were instructed to play *Echo Chamber*. Due to the study being mostly online based, only select participants were under

the observation of an investigator. Once the participant reached the end of the game, he was instructed to fill out the post-questionnaire. With the exception of the demographic questions and persuasive games questions, the post-questionnaire included the same questions as the pre-questionnaire. In addition, participants were asked for what they thought the message of the game was, what the game taught, what they learned from the game, and to comment on what they liked or how the game could be improved.

Following completion of the testing experience, select participants were asked to answer further in depth questions by the investigator. The interview contained questions from the post-questionnaire with additional questions determining the game's effectiveness, and the participant's understanding of the game's goals. These are summarized in the table below.

No.	Questions
1	Briefly, how do you feel about climate change and why?
2	How do you feel about scientists that are presented in the media when discussing climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
3	How do you feel about politicians and journalists that are presented in the media when discussing climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
4	How do you feel about the national media's (CNN, MSNBC, etc) role in presenting climate change? 1. Very favorably, 2. Favorably, 3. Neutral, 4. Unfavorably, 5. Very unfavorably
5	Do you feel empathetic or sympathetic for scientists who present on climate change in public venues, such as the news? 1. Strongly disagree, 2. Disagree, 3. Neutral, 4. Agree, 5. Strongly Agree
6	Do you feel that the game was able to teach the player? If so, what was taught?
7	Do you feel that this game was able to deliver a message to the player? If yes, what was that message?
8	What did you learn from the game?
9	How would you rate your experience? 1. Very unenjoyable, 2. Unenjoyable, 3. Neutral, 4. Enjoyable, 5. Very Enjoyable
10	Do you have any other thoughts or suggestions for the game? (How could it be improved? What did you like or dislike?)

Table 5.2: Post-Study Questionnaire

We originally expected the study to take around 30 minutes to complete. Participants would take roughly 15 minutes to play the game, with the remaining 15 split between the questionnaires. Because of the study being online focused, the actual completion time varied between participants, identified by timestamps on pre and post-study responses. Interviews were an additional 30 minutes, and were conducted

either in person or by phone.

5.2 Primary Study

Results from the primary study indicated 59 percent of 46 participants were Caucasian and 22 percent Asian. Other ethnicities included African-American (4 percent), Mixed (8 percent), Hispanic (2 percent) and Middle Eastern (2 percent). Other participants chose not to self-identify their ethnicity. There was a 1.3:1 male to female ratio during the study. We recruited 36 participants consisting of undergraduate and graduate College of Arts and Sciences students, scientists and technical communicators by emails to classes and individuals. We also recruited 13 undergraduate and graduate students from the digital media program. The participants had a slant towards video game playing, as 8 indicated they played every day, 11 with a few times per week, 11 once per week or less, and 15 with once a month or less. Only 3 participants in the study indicated they never played videogames. Participants were well informed, with 26 reporting they read or watched the news every day, and 16 a few times per week. 4 indicated they checked the news once a week or less, and 2 once per month or less. The majority of participants identified as liberals (17), followed by moderate (12), very liberal (8), conservative (6), and none of the above (5). All but 12 participants had never definitively played a persuasive game before. Two participants were uncertain if they had played a persuasive game, and an additional two indicated that they believed all games were persuasive. Just as the majority of participants believed a persuasive game would be effective, we found data that confirmed a change of opinion after playing *Echo Chamber*.

5.2.1 Results

Data from 46 participants was enough to draw a conclusion, although not without problems. Table 5.3 below illustrates the results from our four Likert-scale questions asked in the pre and post-questionnaires, showing the mean and standard deviation, measured on a scale of one to five. Overall the quantitative answers show that no noticeable change in empathy occurred.

No.	Pre-Study (M)	Pre (SD)	Post-Study (M)	Post (SD)	p-value
1	3.85	.80	3.80	.91	.61
2	2.85	1.07	2.65	.90	.21
3	2.36	.77	2.65	.92	.12
4	3.89	.81	3.85	.90	.86

Table 5.3: Results from Quantitative Questions, Pre-Study to Post-Study

Question 1 *(How do you feel about scientists that are presented in the media when discussing climate change?)* resulted in a mean response of 3.85 out of 5, indicating that participants were slightly favorable towards scientists entering the study. The post-study had nearly the same response at 3.80, signifying that the game caused held beliefs to remain. Deviations between answers slightly increased from pre-study to post, but responses were incredibly similar to before.

Question 2 *(How do you feel about politicians and journalists that are presented in the media when discussing climate change?)* produced similar results to the first question. The mean response changed from 2.85 pre-study, to 2.65 post-study, with

the deviations decreasing from 1.07 to .90. Participants felt slightly unfavorable towards politicians and journalists, and this attitude held after testing had concluded.

Question 3 *(How do you feel about the national media's (CNN, MSNBC, etc) role in presenting climate change?)* yielded data much alike the previous question. Participants looked at the national media more unfavorably than politicians and journalists, and like before, this belief held after game play. The slight increase in means from 2.36 to 2.65, and standard deviations from .77 to .92, indicating participants felt slightly less unfavorable towards the media, though not to a statistically significant degree.

Question 4 *(Do you feel empathetic or sympathetic towards scientists who present on climate change in public venues, such as the news)* continues the trend from the previous questions. Participants entered the study agreeing with the statement with a mean of 3.89, and exited with a nearly indistinguishable selection, at 3.85.

Taken alone, the assessment of these four questions is that the game had little to no impact on participants. If anything, participant's opinions towards scientists, politicians and journalists, decreased, while their opinions on the national media increased, though not to a notable degree. This will be discussed later in the chapter, but the initial concern of participants entering our study inherently empathetic for scientists was valid. Our game did have an impact on participants in the final quantitative question, where they were prompted to rate their experience. The average response was 3.78 out of 5 on a Likert-scale, meaning participants enjoyed *Echo Chamber*. Again, this is likely from their interest in the subject matter. Enjoyment is not the same as a successful outcome though; thankfully in the qualitative questions we found promising trends in responses, indicating participants understood the game's goal and the intended message. Table 5.4 summarizes the qualitative questions designed.

No.	Qualitative Question
1	Do you think that the game was able to teach the player? If so, what was taught?
2	Do you feel that this game was able to deliver a message to the player? If yes, what was that message?
3	What did you learn from the game?

Table 5.4: Qualitative Questions

Participants would rarely deviate from their trending theme once they had determined their answer in question 1. This pattern resulted in four themes: 1) an understanding that scientific communication needs to be reframed based on the audience, 2) the media's impact on public opinion, 3) being taught facts about climate change, and 4) expressing empathy for scientists. These themes are encapsulated in Table 5.5 below. The trends identified are exciting because participants uniformly followed at least one of them, and more importantly, these trends showcase an understanding of the intended message and study goals.

Number of Participants	Themes
23 (50%)	Re-evaluating Scientific Communication
12 (26%)	Media's Impact on Public Opinion
10 (22%)	Taught Facts on Climate Change
10 (22%)	Empathy for Scientists

Table 5.5: Trending Themes from Qualitative Responses

With half of the participants, the largest trend to emerge was the intended message, a re-examining of factually based arguments. This can be seen when one participant mentioned "certain phrases limit or expand audience reception of your case. [I learned] that I argue on the basis of facts, and I am not thinking rhetorically." The need to switch communication styles was echoed by another in the post-questionnaire: "How you communicate should be based on your goal in a particular setting. You need to change up what you say to adapt to the debate, not just keep saying the same things because they are factually accurate." Eloquently conveyed by another participant as "What you say is very important, of course, but HOW you say it is equally important." Participants routinely described persuading an audience while using real information as incredibly difficult, noting that employing more educational rhetoric properly is essential. Or, as one participant said "facts are not always the tipping point." Throughout responses, packaging facts and statistics in a more interesting or understandable way is routinely mentioned, indicating a synthesis of our intended message. For example, several participants mentioned the need for audience appeal, as one participant notes: "I felt like the game was trying to show how difficult it is to maintain audience appeal while presenting real, critical information on a scientific topic." This is encouraging, as this is a major theme from the game. Another recapped talking points from the game with "presentation is done in a variety of ways, including digestible facts (percentages, not fractions), emotional appeals and relevant statistics [...] the way in which the material is presented can affect how thoroughly the audience is convinced." Likewise, "the game teaches the player more about how to appeal to an audience than about climate change." Other tenets from *Echo Chamber* are mentioned, culminating with an indication towards better messaging paths for scientific communication.

The second trend to emerge is intriguing because this was not expected in our

design. A number of participants thought the game's focus was on how the media will downplay issues in favor of ratings. Says one participant, "the news media uses their guests and hosts to promote a specific agenda based on ratings." Instructions given to the player in game were seen by some participants as evidence of how the media obfuscates issues to focus on ratings. In a similar vein, many felt the game was emphasizing a distrust of the media in general, encouraging other resources to formulate opinions. This is taken to something of a logical conclusion with "the media influences public opinion more than politicians and scientists," and "the media is secretive." The media was seen as a powerful shadow agency, willing to drop reliable news sources and hosts for low ratings, ready to "manipulate the truth to serve an agenda." Although not uncommon, this distrust was not the dominant opinion. Others demonstrated a more reserved approach, indicating that current modes of discussion in the media, or rather arguments, are fruitless and damaging. We think this trend occurred due to our game's satire, and the in-game instructions relayed to players during interlude levels.

The trend towards gaining knowledge on climate change through gameplay is not surprising considering the entire discussion of *Echo Chamber* is centered around it. Commonly, this was seen as a method of convincing "non-believers" about the truth. What's interesting is participants in this category expressed a realization of how climate change is actually impacting the planet, and those presenting on it need our attention even if the facts are not communicated in an appealing manner - essentially, the opposite of our intended message. Some felt that the game would be effective as a teaching tool only if players were uniformed about climate change, as one participant remarked "honestly [I didn't learn] much but i am oddly over-informed about this stuff." More interesting still is the disparity between the player character's knowledge on climate change and the player's. One participant notes "[the player character] had

more scientific and political knowledge than I have, and we he talked, he often said things that I didn't know, and that taught me." *Echo Chamber* had the unintended effect of teaching climate change to some participants in a more appealing way due to the player character's journey, while the facts, statistics, and topics mentioned in game gave participants a frame of reference.

Responses expressing empathy or sympathy towards scientists were unsurprising considering the testing group. Many mentioned the difficulty scientists have with communicating, or arguing purely factually. One participant bemoaned "I felt that this game only showed me how hard it is to argue for my side." Related to the media distrust, much of the empathy was generated by scientists encountering staunch opponents, and having their actions dictated by production needs. "It's very difficult for scientists to know how to respond on the spot when they get hit with politicized misinformation," says one participant, who stresses that debates involving scientists should not be taking place because "it's very hard for them to get their message across in the media." These responses reaffirm the empathy found in quantitative questions, though in a much more in-depth manner.

Participants were also asked for feedback on *Echo Chamber* in the final question *(How could the game be improved? What did you like or dislike? Was the game enjoyable or not at all? Any thoughts or suggestions are welcome.)*. Responses given could be incredibly useful for either expanding this project or other similar persuasive games. Many participants wished the game was longer or had more levels, wanting to see more of the player character's story. What's interesting is participants mentioned playing the game not as themselves, but as the player character, answering questions how they thought he would answer. The antagonist was received very well, a "perfect foil." Perhaps the most common piece of feedback was towards the game's difficulty - the vast majority did poorly in game, mentioning the need for a tutorial level,

and making the first level less impactful overall. The difficulty had a positive side effect however, as participants frequently mentioned the game's "good replay value," wanting to experience other endings, and beating the antagonist. Similarly, another frequent piece of feedback was the choice timer depleting far too rapidly, though some understood the design goal and noted that it was possibly necessary. Choice was praised, as many liked being able to pick the character's response, incidentally forcing them to read everything. While some liked the 8-bit aesthetics and music, the vast majority reported feeling distracted by the music, and equally found the font used for dialog choices hard to read. Finally, suggestions for further iterations were given, with some wishing more instructions were given in between levels, and having a bibliography of terms during or after gameplay. Having a choice between player avatars was mentioned, which could lead to players being more immersed. A "more sophisticated" version was readily mentioned and requested, this version just "needs honing."

A total of 11 participants were interviewed once testing had completed. They were made up of an expert panel consisting of two Environmental Policy graduate students and one Technical Communication graduate student, one scientist and researcher, and one member of a Public Relations firm for helping scientists communicate with the public. Digital Media graduate students filled the remaining six slots. The three qualitative questions from the post-questionnaire were asked again, in addition to the questions summarized below in Table 5.6.

No.	Interview Question
1	Do you feel that the game was able to deliver a message, and if yes, what was that message?
2	Could the message have been delivered in a more effective manner?
3	Do you feel that the game was able to teach the player, and if so, what was taught?
4	Briefly, what did you learn from the game?
5	Based on your experiences, was the game effective at illustrating the public discourse of climate change and why?
6	Do you feel the game was effective at providing communication techniques for scientists in the media?
7	Can you provide an example from playing the game?
8	Where could the game improve providing communication techniques?
9	Generally, how could the game be improved? What did you like or dislike? Was the game enjoyable or not at all? Any thoughts or suggestions are welcome.

Table 5.6: Interview Questions Summarized

Overall, the interviews revealed further promising in-depth data. The expert panel routinely responded with trends indicating a need to reframe their arguments, and expressing the problem with scientific communication. One participant said the game "certainly taught me to shift the kind of rhetoric you're using with the public. You can't use the same kind of tone or rhetoric that dissenting opinions are using." Another participant agreed with "I started with factual arguments and lost! It made me sensitive to rhetorical arguments and audience persuasion." These responses are interesting not just because they reinforce qualitative trends, but from the stark contrast participants saw these techniques with. They simply had not considered utilizing them before, making the results all the more exciting. The panel

demonstrated further synthesis of our intended message when discussing what they learned from the game. One participant mentioned the difficulty in choosing what to say to persuade others, with others emphasizing the need to pick the right statement at the right time. All five from the expert panel mentioned how the game would be a good start for making scientists think critically about their communication style. As one participant said "my argumentation style doesn't work outside of [my profession]." Two participants offered insight for expanding this concept. The main takeaways were giving the player more time and feedback during levels, offering more chances to retry before failure, and giving players a customizable player character to further immerse them in the experience.

Responses from the digital media interviews indicated they also understood the intended message, but in varying degrees. One participant, convinced that the game's message was about allowing a purely facts based show to be on the air, inadvertently revealed the need for our game: "I am that audience that would get bored if a scientist was just spouting facts at me." Others were more overt: when prompted to describe communication techniques from our game, one participant summarized the need to be understood while not unleashing technical jargon. Digital media participants consistently demonstrated a synthesis of the game's themes, but did not offer in depth feedback on the game like the expert panel.

5.3 Analysis and Discussion

Based on the quantitative responses, *Echo Chamber* did not have a meaningful impact on empathy, but qualitative trends suggest that our game was able to persuade participants to re-examine how to frame scientific data. This supports our claim to persuade through procedural rhetoric. Responses recorded indicate that our game was able make participants aware of more effective methods of communication, while

highlighting empathy they have towards scientists. However, there is the question of how long this awareness will last, or if new rhetorical methods will be actively utilized. The same can be said for any game trying to teach or persuade players, and this could open further investigation for persuasive games.

Other trends identified indicate that our method was not wholly effective, but the data generated is highly interesting. We had designed the in-game emails to give feedback on player performance and preparation for upcoming levels. We did not foresee the qualitative trend associated with the media being reinforced by the emails, nor did we predict participants fixating on the media's impact. This suggests that the satirical element in our game was too over the top, or the producer NPC's input was too overt. Though the media is a part of the problem, and this was reflected in our design decisions, this was not the intended message.

Qualitative trends suggest that *Echo Chamber* was incidentally a learning tool for climate change. Because our sample size was already informed on climate change, we did not expect our study to teach subjects what they already know. However, enough reported learning facts about climate change from the experience to suggest otherwise. What's exciting is the implication that learning occurred even when topics and knowledge were unknown. The player character, portrayed as an expert in climate science, could discuss topics unfamiliar to a participant, and he would still learn as a result. Future work could investigate this notion of uninformed learning in gameplay.

Open ended responses in our post-questionnaire and interviews revealed a number of improvements for Echo Chamber, with the difficulty being a primary component. Originally designed to recreate the time pressure in debating, the choice timer was far too fast for participants. Early playtesting sessions with digital media students, who play videogames more than our average participant, had helped define the time allotted for choices in game. There's a more balanced iteration that still could be

identified. What's notable though is that participants routinely reported enjoying the game and the game's narrative, also finding that the high difficulty served as an incentive for replaying *Echo Chamber*. Other comments related to game design included helpful suggestions for polishing hypothetical future iterations.

Overall, many of the open ended comments acknowledged that scientific arguments must be shifted depending on the audience. There seems to be a consistent understanding from participants or at least an awareness of techniques.

6. Conclusion

6.1 Conclusion

Persuasive games and games for change function efficiently when their procedural rhetorics are built to support the subject matter. Although climate change is a popular topic in media, the games we examined either do not effectively mount procedural rhetoric for persuasion, or stifle player agency by negating interactivity. *Oiligarchy*, the oil-tycoon persuasive game, serves as an excellent example of procedural rhetoric, as its rules and processes are designed to change player opinion through interactive play. Now, we feel that *Echo Chamber* can be added to this list.

The science of climate change is communicated poorly outside of academic circles. Scientists are accustomed to rely on factual arguments, filled with technical jargon understandable to them. Because communicating with the general public has never been a priority, scientists are caught flat-footed in debates, often ensnared in logical traps designed to obfuscate the topic. The media readily supports this, portraying scientist and contrarian on an even level. We took the strategies used by this contrarian movement and research intended to teach scientists better methods of illustrating climate change to inform our design.

Echo Chamber was designed so users would re-examine their rhetorical strategies. Through this, they can understand how to be better communicators, while fostering a sense of empathy or sympathy for scientists trapped in debate by contrarians. To best achieve our goal, we determined the player character must be a scientist, following orders from his producer to earn ever higher ratings. Our game procedurally emphasizes the player to rethink his debate strategy, as our game mechanic is designed around selecting dialog options for the player character. Feedback in game is similarly

implemented to serve this design goal. Instantaneous feedback through visual and audio cues prompt the player to continue or abandon his current strategy. Between the game's three levels are interludes featuring feedback from the producer NPC, who evaluates the player's performance and provides lessons for the upcoming level. Each level was designed to serve a theme; these themes were determined for their overall importance in scientific communication and learning potential.

Our study consisted of 46 participants, with the majority having a background in Environmental Policy and communication. Through pre and post-study questionnaires consisting of quantitative and qualitative questions, we were able to determine that *Echo Chamber* had indeed encouraged 23 participants to re-examine their rhetorical strategy, with other interesting qualitative trends emerging. Due to our study sample, we did not instill a greater sense of empathy for scientists who debate in public venues because the majority of participants entered our study inherently empathetic. This was reaffirmed in qualitative responses - 10 participants expressed empathy for scientists. *Echo Chamber's* potential as a learning tool was routinely praised during our study, with participants enjoying the game despite its high difficulty, and some heralding the game's unique nature. One common qualitative trend was participants fixating on the media due to the overtly satirical news network of our game. This is interesting because it suggests satire overpowered the intended message. *Echo Chamber* also taught factual information about climate change due to every line of game dialog centering around the subject matter. This could serve as an example for future learning games, because participants who entered our study without a large body of climate knowledge left with a frame of reference. A set of interviews we conducted with 11 participants after completing the post-questionnaire reaffirmed the effectiveness of our game. The in-depth responses we received added further insight into future persuasive designs.

We believe that the design of *Echo Chamber* was successful to a certain extent in persuading participants to reframe how to communicate scientific data, and that our design can serve as an example for other games interested in similar mechanics or subject matter. However, our game can be improved on multiple fronts. The game's high difficulty and the 12 second time pressure for dialog choices were frequently mentioned for further balancing and iteration. One might consider offering multiple player characters in persuasive games, as this was a commonly requested feature during our study. For our study, we felt that having one player character with a defined narrative would be adequate, so this was not considered during development due to scope. Likewise, our pixel art aesthetic may have hurt the experience for some participants, and in particular, the font we used on dialog options. In-game music, implemented for reinforcing pressure, was annoying to a number of participants, but enjoyable for others. Our opinion from this feedback is that persuasive games should adopt a modern art style, unless they are specifically targeting fans of pixel art and older videogames.

Despite the room for improvement, we feel that *Echo Chamber* stands as an example of procedurally persuading through game mechanics. In particular we're excited that our intended message, that scientific communication must be shifted depending on the venue, was readily received. Our game is the first to illustrate the disconnect between scientists, politicians, the media, and the general public, but our hope is that other developers will build off our success.

6.2 Future Work

There are several possibilities for building off *Echo Chamber* and its unique potential. One of the more exciting avenues would be testing the game with a younger group of participants. The learning opportunities offered with this game could yield

significant findings if middle school children, for example, were the sample group. This would be an avenue to determine if our game is effective at changing opinions, particularly empathy in addition to teaching rhetorical strategies. Similarly, testing on a group that does not enter inherently empathetic for scientists, or denies climate change, could be illuminating.

Adding a female playable character, or a customizable player character, was frequently mentioned by participants as a requested feature. Players could be more immersed in the game if they had an avatar modeled after their resemblance, and exploring themes put forth in *Echo Chamber* with the added challenges faced by female scientists would be incredibly interesting, and enlightening.

If development on *Echo Chamber* continues, expanding the player character's story with several additional levels, environments and scenarios would be essential. Many scrapped features could be reintegrated into the game. For example, debates are rarely as polite as they are in *Echo Chamber*, relatively speaking. A future version could include opponents interrupting the player character, and how to deal with one. One requested feature was including a bibliography of sorts in the game - this could be implemented as part of a research system during gameplay. Additionally, the overall gameplay could be revamped. Aside from easing the difficulty and allowing more time to make choices, a new version of the game could offer several opportunities to get an answer correct, with more in depth evaluations at the end of levels. Players could dive into answers to learn why an answer was correct or vice versa. This would additionally lend itself to the requested bibliography, and potentially a more rhythmic style of play.

Finally, the gameplay of *Echo Chamber* could be adapted to other topics for a more generalized learning tool. This could be more educational in nature, or center on general debate tactics and rhetoric.

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